General

Guideline Title

Steps to reduce surgical risk. In: II guidelines for perioperative evaluation.

Bibliographic Source(s)

Gualandro DM, Yu PC, Calderaro D, Marques AC, Pinho C, Caramelli B, et al. Steps to reduce surgical risk. In: II guidelines for perioperative evaluation. Arq Bras Cardiol. 2011;96(3 Suppl 1):23-41. [379 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Arq Bras Cardiol 2007;89(6):e197-208.

Recommendations

Major Recommendations

Note from the National Guideline Clearinghouse (NGC): The Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography (DECREASE) studies have been discredited following an investigation into scientific misconduct by the Erasmus Medical Center in the Netherlands. The DECREASE family of trials are a major source of evidence for recommendations for perioperative initiation of a course of beta-blockers in those at risk of cardiac events undergoing high- or intermediate-risk non-cardiac surgery or vascular surgery*. The guideline on which this NGC summary is based has been identified as having referenced or having been in-part based on the DECREASE trials. We recommend prudence in applying the recommendations of this guideline where the DECREASE trial results may have played a role.

*Reference: Bouri S, Shun-Shin MJ, Cole GD, et al. Heart Published Online First:[July 31, 2013] doi:10.1136/heartjnl-2013-304262.

The definitions for levels of evidence (A-C) and classes of recommendation (I-III) are provided at the end of the "Major Recommendations" field.

Perioperative Medical Therapy

Beta-blockers

Recommendations for perioperative beta-blocker use:

Degree of Recommendation I

- Candidates for arterial vascular surgeries with symptomatic myocardial ischemia or myocardial ischemia on functional test; Level of

Evidence B

- Candidates for nonvascular surgeries with symptomatic myocardial ischemia or myocardial ischemia on functional test; Level of Evidence C
- Patients already receiving beta-blockers chronically should keep using them throughout the perioperative period; Level of Evidence B.

Degree of Recommendation IIa

- Candidates for vascular surgeries with intermediate cardiac risk; Level of Evidence B

Degree of Recommendation IIb

- Candidates for nonvascular surgeries with intermediate cardiac risk; Level of Evidence B

Degree of Recommendation III

- Patients with contraindication to beta-blockers; Level of Evidence B

Statins

Recommendations for perioperative use of statins:

Degree of Recommendation I

- Patients who will undergo vascular surgeries; Level of Evidence A
- Patients diagnosed with coronary artery disease; Level of Evidence C
- Patients who already use statins; Level of Evidence B

Degree of Recommendation IIb

- High-risk patients (American College of Physicians [ACP] classes II and III); Level of Evidence C

Alpha-Agonists

Recommendations for perioperative use of clonidine:

Degree of Recommendation IIa, Level of Evidence A

- Cardiac patients who will undergo vascular surgeries and have contraindications to beta-blockers

Antiplatelet Agents (AAS)

Recommendations for antiplatelet agents before noncardiac surgeries:

Degree of Recommendation I

- Patients with coronary artery disease and noncardiac surgery scheduled should maintain the use of AAS at a low dose of 75 to 100 mg/day, except in neurosurgeries and transurethral resection of the prostate; Level of Evidence B.
- Patients using dual antiplatelet therapy by means of recent angioplasty with stent should keep receiving AAS throughout the perioperative period, with discontinuation of thienopyridine 5 days before surgery and reintroduction as early as possible, ideally before the patient completes 10 days of discontinuation; Level of Evidence C.
- Patients receiving antiplatelet therapy only with thienopyridine and surgery scheduled with moderate to high-risk of bleeding should discontinue medication 5 days before; Level of Evidence C.

Degree of Recommendation IIa

- Keep dual antiplatelet therapy in procedures with low risk for bleeding; Level of Evidence C.
- Patients receiving antiplatelet therapy only with thienopyridine and surgery scheduled with low risk of bleeding should continue medication in the perioperative period; Level of Evidence C.

Preoperative Coronary Revascularization

Recommendations for (surgical or percutaneous) myocardial revascularization before noncardiac surgeries:

Degree of Recommendation I

- Patients with indication of myocardial revascularization, regardless of perioperative context who are scheduled to undergo elective noncardiac surgeries; Level of Evidence C
- Patients with evidence during perioperative evaluation of extensive ischemic areas, low ischemic threshold, and high-risk coronary anatomy: lesion of left main coronary artery or triple-vessel disease with ventricular dysfunction; Level of Evidence C

Degree of Recommendation IIa

- Patients without high-risk functional or anatomical markers for perioperative cardiac complications but with indication of myocardial revascularization before intermediate or high risk noncardiac surgeries (e.g.; patients with single-vessel disease in right coronary artery, stable angina Canadian Cardiovascular Society (CCS) II and without ventricular dysfunction with scheduled vascular, intraperitoneal, and intrathoracic surgery); Level of Evidence C

Degree of Recommendation IIb

- Patients without high-risk functional or anatomical markers for perioperative cardiac complications but with indication of myocardial revascularization before low-risk noncardiac surgeries; Level of Evidence C

Degree of Recommendation III

- Patients in need of emergency, noncardiac surgery regardless of symptom severity or degree of coronary artery obstruction; Level of Evidence C
- Patients with bad prognoses because of severe noncardiac illness who may be submitted to palliative surgeries such as gastrostomy, gastric/intestinal bypass, tracheotomy, etc.; Level of Evidence C

Recommendations regarding safe intervals between myocardial revascularization and noncardiac surgery:

Degree of Recommendation I

- After surgical myocardial revascularization
  - Ideal interval: 30 days; Level of Evidence C
  - Minimum interval: depends on the clinical condition of the patient; Level of Evidence C
- After balloon angioplasty without stenting
  - Ideal interval: 14 days; Level of Evidence B
  - Minimum interval: 7 days; Level of Evidence C
- After angioplasty with conventional stenting
  - Ideal interval: over 6 weeks; Level of Evidence B
  - Minimum interval: 14 days; Level of Evidence C
- After angioplasty with drug-eluting stent
  - Ideal interval: undefined; Level of Evidence C
  - Minimum interval: 365 days; Level of Evidence B

Venous Thromboembolism Prophylaxis

General Recommendations

Degree of Recommendation I

- Do not use aspirin alone in any group of patients as thromboprophylaxis for venous thromboembolism (VTE); Level of Evidence A.
- Use mechanical methods of thromboprophylaxis primarily in patients at high risk of bleeding; Level of Evidence A.
- With respect to each antithrombotic agent, follow the doses recommended in the guidelines of each manufacturer; Level of Evidence C. Generally, consider the use of prophylactic unfractionated heparin (UFH) at a dose of 5000 International Units (IU) subcutaneous (SC) 12/12h or 8/8h; prophylactic low molecular weight heparin (LMWH) (dalteparin 5000 IU SC once a day, tinzaparin 4500 IU SC once a day or enoxaparin 40 mg SC once a day) and fondaparinux at doses of 2.5 mg SC once a day (in subjects >50 kg).
- Assess renal function when considering the use and the dose of LMWH, fondaparinux, or other antithrombotic agent excreted by the kidneys especially in elderly and diabetic individuals, or those at high risk of bleeding; Level of Evidence A. In these circumstances, avoid the use of antithrombotic drugs with renal metabolism. Use lower doses of the drug, or monitor the serum level of the drug and its anticoagulant effect; Level of Evidence B.

Degree of Recommendation IIa

- Use mechanical methods of thromboprophylaxis in patients at high risk of bleeding with an adjuvant to anticoagulant thromboprophylaxis; Level of Evidence A.

General Surgeries

For patients undergoing low-risk general surgery procedures such as minor surgeries that do not have other additional risk factors for VTE the only recommendation is early and frequent ambulation.

Degree of Recommendation I

- For patients undergoing moderate-risk general surgery such as a major procedure for a benign disease, use thromboprophylaxis with LMWH, prophylactic UFH, or fondaparinux; Level of Evidence A.
- For patients undergoing higher-risk general surgery such as a major procedure for neoplasia, use thromboprophylaxis with LMWH, prophylactic UFH 8/8h, or fondaparinux; Level of Evidence A.
- For patients undergoing general surgery with multiple risk factors for VTE who may be at a higher risk category, use a pharmacological method (LMWH, prophylactic UFH 8/8h, or fondaparinux) in combination with a mechanical method (elastic stockings and/or intermittent pneumatic compression [IPC]); Level of Evidence C.
- For patients undergoing general surgery with a high risk of bleeding, use a mechanical method of thromboprophylaxis (elastic stockings and/or IPC); Level of Evidence A. Once there is a decreased risk of bleeding, replace it or add pharmacological thromboprophylaxis; Level of Evidence C.
- Regarding the duration of thromboprophylaxis, in major general surgery, keep it until hospital discharge; Level of Evidence A.

Degree of Recommendation IIa

- Regarding the duration of thromboprophylaxis, in major general surgeries for selected patients at the highest risk, including those undergoing major surgery for cancer or with previous VTE, consider the use of thromboprophylaxis after hospital discharge with LMWH for up to 28 days; Level of Evidence A.

Table 1. Recommended Thromboprophylaxis According to the Levels of Thromboembolic Risk in Hospitalized Patients*

Risk Classes	Approximate Risk of DVT in the Absence of Thromboprophylaxis[&]	Options of Thromboprophylaxis
Low risk		
Minor surgery in patients who can walk	<10.0%	No specific thromboprophylaxis
Clinical patients who can walk		Early and intensive ambulation
Moderate risk		
Most general, gynecological and open urological surgeries		LMWH (at recommended doses), low dose of UFH or
Clinical patients confined to bed or seriously ill		12/12h or 8/8h, fondaparinux
Moderate risk of VTE + high risk of bleeding	10%-40.0%	
		Mechanical thromboprophylaxis[#]
High risk		
Hip or knee arthroplasty, hip fracture surgery		LMWH (at recommended doses), fondaparinux,
Major traumas, spinal cord injury	40%-80.0%	or warfarin (INR 2.0-3.0)
High risk of VTE + high risk of bleeding		Mechanical thromboprophylaxis[#]

Risk Classes	Approximate Risk of DVT in the Absence of Thromboprophylaxis[&]	Options of Thromboprophylaxis

*The descriptive terms were purposely left undefined to allow for individual clinical interpretation; [&]Scores based on objective diagnostic tests in patients with asymptomatic DVT without the use of thromboprophylaxis; [#]Mechanic thromboprophylaxis includes intermittent pneumatic compression and/or elastic compression stockings. Consider returning to anticoagulant thromboprophylaxis after decreasing the risk of bleeding; VTE - venous thromboembolism, LMWH - low molecular weight heparin, UFH - unfractionated heparin; DVT - deep vein thrombosis; INR - international normalized ratio.

Vascular Surgeries

Degree of Recommendation I

- For patients undergoing major vascular surgeries with risk factors for VTE, use thromboprophylaxis with LMWH, prophylactic UFH, or fondaparinux; Level of Evidence C.

Degree of Recommendation IIa

- For patients undergoing vascular surgeries without other risk factors for VTE, use only early and frequent ambulation; Level of Evidence C.

Gynecological Surgeries

Degree of Recommendation I

- For patients undergoing minor, low-risk gynecological surgery without risk factors for VTE, use early and frequent ambulation; Level of Evidence A.
- Similarly, for gynecological patients undergoing laparoscopic surgeries, use only early and frequent ambulation; Level of Evidence B.
- For gynecological patients undergoing laparoscopic surgeries with additional risk factors for VTE, use thromboprophylaxis with LMWH, prophylactic UFH and/or elastic stockings and IPC; Level of Evidence C.
- For patients undergoing major gynecological surgery for benign disease without additional risk factors for VTE, use LMWH, prophylactic UFH (Level of Evidence A); or IPC immediately before surgery until the patient can walk; Level of Evidence B.
- For patients undergoing major gynecological surgery for neoplasia and for patients with multiple risk factors for VTE, use routine prophylaxis with LMWH, prophylactic UFH 8/8h (Level of Evidence A); or IPC immediately before surgery until the patient can walk; Level of Evidence A. Alternatively, consider the combination of LMWH or prophylactic UFH associated with mechanical thromboprophylaxis with elastic stockings or IPC, or fondaparinux; Level of Evidence C.
- For patients undergoing major gynecological surgeries, keep thromboprophylaxis until hospital discharge; Level of Evidence A.

Degree of Recommendation IIa

- For patients at the highest risk, including those undergoing major surgeries for cancer, as well as those with a history of previous VTE, consider the use of thromboprophylaxis with LMWH for up to 28 days after discharge; Level of Evidence C.

Major Urological Surgeries

Degree of Recommendation I

- For patients undergoing transurethral surgeries, as well as other low-risk urological surgeries, use only early and frequent ambulation; Level of Evidence A.
- For patients undergoing major urological open surgeries, use routine thromboprophylaxis with prophylactic UFH 12/12h or 8/8h (Level of Evidence B); elastic compression stockings and/or IPC immediately before surgery until the patient can walk (Level of Evidence B); LMWH, fondaparinux or the combination of pharmacological and mechanical thromboprophylaxis (elastic compression stockings and/or IPC); Level of Evidence C.
- For urologic patients who have active bleeding or at high risk of bleeding, use mechanical methods of thromboprophylaxis adequately (elastic compression stockings and/or IPC) until the bleeding risk decreases; Level of Evidence A. Once there is decreased risk of bleeding, replace mechanical methods or add pharmacological thromboprophylaxis to the mechanical method; Level of Evidence C.

Laparoscopic Surgeries

Degree of Recommendation I

- For patients undergoing laparoscopic surgeries without risk factors for VTE, use only early and frequent ambulation; Level of Evidence A.
- For patients undergoing laparoscopic surgery with additional risk factors for VTE, use LMWH, prophylactic UFH, fondaparinux and/or elastic stockings or IPC; Level of Evidence C.

Bariatric Surgeries

Degree of Recommendation I

- For patients undergoing bariatric surgery, routinely use thromboprophylaxis with LMWH, prophylactic UFH 8/8h, fondaparinux, or the combination of a pharmacological method with IPC; Level of Evidence C.

Degree of Recommendation IIa

- These patients should receive higher doses of LMWH (enoxaparin 40 mg SC 12/12h) or UFH (7500 UI SC 8/8h) than those commonly used in the prophylaxis of non-obese patients; Level of Evidence C.

Thoracic Surgeries

Degree of Recommendation I

- For patients undergoing major thoracic surgeries, routinely use thromboprophylaxis with LMWH, prophylactic UFH, or fondaparinux; Level of Evidence C.
- For patients at high risk of bleeding, properly use mechanical methods of thromboprophylaxis (elastic compression stockings and/or IPC); Level of Evidence C.

Orthopedic Surgeries

Elective Hip Prosthesis Surgery

Degree of Recommendation I

- For patients undergoing elective hip prosthesis surgery (HPS), routinely use one of the following thromboprophylaxis regimens: A) LMWH (started 12 h before surgery or 12 to 24 h after surgery, or 4-6 h after surgery at half the usual dose, increasing to the usual dose the next day); B) fondaparinux (2.5 mg started 6 to 24 h after surgery); or C) warfarin started in the preoperative period or in the evening before surgery, keeping the international normalized ratio (INR) between 2.0 and 3.0; Level of Evidence A (up to INR above 2.0, also administer another prophylaxis method).
- Do not use the following methods as single thromboprophylaxis: aspirin, dextran, or elastic compression stockings; Level of Evidence A.
- For patients with a high risk of bleeding, use IPC adequately; Level of Evidence A. Once there is a decreased risk of bleeding, replace the mechanical method or add pharmacological thromboprophylaxis; Level of Evidence C.

Degree of Recommendation IIa

- When LMWH cannot be used for safety or availability reasons, use unfractionated heparin 5000 U 8/8h; Level of Evidence C.

Elective Knee Prosthesis Surgery

Degree of Recommendation I

- For patients undergoing elective knee prosthesis surgery, routinely use thromboprophylaxis with LMWH, fondaparinux or warfarin (INR 2.0-3.0); Level of Evidence A.
- Proper use of the IPC in this group of patients can be done instead of pharmacological thromboprophylaxis; Level of Evidence B.
- Do not use aspirin as a single thromboprophylaxis method; Level of Evidence A.
- For patients with a high risk of bleeding, use IPC adequately; Level of Evidence A. Once there is a decreased risk of bleeding, replace the mechanical method or add pharmacological thromboprophylaxis; Level of Evidence C.

Degree of Recommendation IIa

- When LMWH cannot be used for safety or availability reasons, use unfractionated heparin 5000 U 8/8h; Level of Evidence C.

Knee Arthroscopy

Degree of Recommendation I

- For patients undergoing knee arthroscopy with risk factors for VTE or a complicated surgical procedure, use LMWH; Level of Evidence B.

Degree of Recommendation IIa

- For patients undergoing knee arthroscopy without additional risk factors for VTE, use only early ambulation; Level of Evidence B.

Hip Fracture Surgery

Degree of Recommendation I

- For patients undergoing hip fracture surgery routinely use thromboprophylaxis with fondaparinux (Level of Evidence A), LMWH, or warfarin, keeping INR between 2.0 to 3.0; Level of Evidence B.
- Do not use aspirin as a single thromboprophylaxis method; Level of Evidence A.
- In patients for whom a delay in surgical correction is expected, use thromboprophylaxis with LMWH or prophylactic UFH in the period between hospital admission and surgery; Level of Evidence C.
- For patients with a high risk of bleeding, use IPC adequately; Level of Evidence A. Once there is a decreased risk of bleeding, replace the mechanical method or add pharmacological thromboprophylaxis; Level of Evidence C.

Degree of Recommendation IIa

- When LMWH cannot be used for safety or availability reasons, use unfractionated heparin 5000 U 8/8h; Level of Evidence C.

Beginning of Thromboprophylaxis in Major Orthopedic Surgeries

Degree of Recommendation I

- For patients receiving LMWH in major orthopedic surgeries, the beginning of its administration can be both preoperatively and immediately postoperatively; Level of Evidence A.
- For patients receiving fondaparinux as thromboprophylaxis, begin medication 6-8 h after surgery or the next day; Level of Evidence A.

Prehospital Discharge Screening for DVT

Degree of Recommendation I

- For asymptomatic patients undergoing major orthopedic surgeries, routine use of venous Doppler ultrasound of lower limbs as screening method for DVT before hospital discharge is not recommended; Level of Evidence A.

Thromboprophylaxis Duration

Degree of Recommendation I

- For patients undergoing hip and knee prosthesis surgeries or hip fracture repair, use thromboprophylaxis for at least 10 days after surgery; Level of Evidence A.
- For patients undergoing hip prosthesis surgery or hip fracture repair, prolong thromboprophylaxis from 10 to 35 days after surgery (Level of Evidence A) using LMWH (Level of Evidence A), warfarin (Level of Evidence B), or fondaparinux; Level of Evidence C.

Degree of Recommendation IIa

- For patients undergoing knee prosthesis surgery, prolong thromboprophylaxis from 10 to 35 days after surgery, using LMWH, warfarin, or fondaparinux; Level of Evidence B.

Elective Spinal Cord Surgery

Degree of Recommendation I

- For patients who have additional risk factors for VTE such as neoplasia, neurological impairment, advanced age, previous VTE, or previous surgery, use prophylactic UFH, LMWH, or IPC in the postoperative period; Level of Evidence B.

Degree of Recommendation IIa

- For patients undergoing spinal cord surgery without additional risk factors for VTE, use only early and frequent ambulation; Level of Evidence C.
- For patients who have additional risk factors for VTE such as neoplasia, neurological impairment, advanced age, previous VTE, or previous surgery, there is the possibility of considering the use of elastic compression stockings; Level of Evidence B.
- For patients with multiple risk factors, associate a pharmacological method of thromboprophylaxis (prophylactic UFH or LMWH) with a mechanical method (IPC and/or elastic compression stockings); Level of Evidence C.

Neurosurgery

Degree of Recommendation I

- For patients undergoing major neurosurgeries, use routine mechanical thromboprophylaxis by means of IPC; Level of Evidence A.

Degree of Recommendation IIa

- For patients undergoing major neurosurgeries, the use of postoperative LMWH (Level of Evidence A) and prophylactic UFH (Level of Evidence B) are acceptable alternatives.
- For patients with a higher risk of VTE, use a combination of a mechanical method (IPC and/or elastic compression stockings) and a pharmacological method (LMWH or prophylactic UFH postoperatively); Level of Evidence B.

Trauma

Degree of Recommendation I

- Whenever possible, use thromboprophylaxis in all patients suffering from major trauma; Level of Evidence A.
- In patients suffering from major trauma and without significant contraindications, use LMWH as early as possible considering safety issues; Level of Evidence A. A possible alternative is the combination of LMWH and a mechanical method of thromboprophylaxis; Level of Evidence B.
- In patients with contraindications to the use of LMWH because of active bleeding or high risk of bleeding, use a mechanical method of thromboprophylaxis such as IPC or possibly elastic compression stockings alone; Level of Evidence B. Once there is a decreased risk of bleeding, replace it or add pharmacological thromboprophylaxis; Level of Evidence C.
- Do not use inferior vena cava filter as a thromboprophylaxis method in patients suffering from trauma; Level of Evidence C.
- Keep thromboprophylaxis until hospital discharge; Level of Evidence C.

Acute Spinal Cord Injury

Degree of Recommendation I

- Use thromboprophylaxis for all patients with acute spinal cord injury [Level of Evidence A] by means of LMWH initiated once bleeding is confirmed; Level of Evidence B. Alternatively, the combination of IPC and/or prophylactic UFH [Level of Evidence C] or LMWH; Level of Evidence C.
- For patients at high risk of bleeding, use elastic compression stockings and/or IPC; Level of Evidence A. Once there is decreased risk of bleeding, replace mechanical methods or add pharmacological thromboprophylaxis; Level of Evidence C.
- For patients with incomplete spinal cord injury associated with local hematoma evidenced on computed tomography (CT) or magnetic resonance imaging (MRI), use mechanical thromboprophylaxis during the first days after injury; Level of Evidence C.
- In this group of patients, do not use vena cava filter as a thromboprophylaxis method; Level of Evidence C.
- For patients receiving rehabilitation treatment after injury, keep LMWH or start warfarin (INR 2.0-3.0); Level of Evidence C.

Oncological Surgeries

Degree of Recommendation I

- Patients undergoing laparotomy, laparoscopy, or thoracotomy lasting longer than thirty minutes should receive prophylaxis with heparin, except if there are contraindications; Level of Evidence A.
- Thromboprophylactic mechanical methods can be associated with pharmacological methods, but not as a single therapy, unless there are contraindications to pharmacological methods; Level of Evidence A.
- Combined prophylaxis (mechanical and pharmacological) may be used, in order to increase efficiency, especially in patients at high risk; Level of Evidence A.

Perioperative Anticoagulation Management

Risk of Thromboembolism

High-risk Patients

- Mechanical prostheses: any mechanical prosthesis in the mitral position, old aortic mechanical prosthesis or with stroke or transient ischemic attack (TIA) within the last 6 months
- Atrial fibrillation (AF) with $CHADS_2$* greater than 5, associated with valvular heart disease or stroke or TIA within the last 3 months
- VTE: recent (past 3 months) or associated with severe thrombophilia (deficiency of protein C, S, antithrombin or presence of antiphospholipid antibody)

Intermediate-risk Patients

- Aortic mechanical prostheses with old AF, stroke, or TIA, older than 75 years, heart failure, hypertension, or diabetes
- AF with $CHADS_2$* of 3 or 4
- VTE in the last 3-12 months, mild thrombophilia (heterozygous mutations of factor V or factor II Leiden), recurrent VTE, or active cancer

Low-risk Patients

- Aortic mechanical prostheses with no risk factors for stroke
- AF with $CHADS_2$* from 0 to 2, without previous stroke or TIA
- VTE longer than 12 months ago without other risk factors

* $CHADS_2$: heart failure = 1 point, hypertension = 1 point, age > 75 years = 1 point, diabetes = 1 point, stroke or TIA = 2 points

Procedures with Low Risk of Bleeding

- Cataract surgery
- Minor dermatological procedures
- Dental procedures - hygiene, simple extraction, restoration, endodontic, and prosthetic procedures

Recommendations

Patients at High Risk of Thromboembolism

Degree of Recommendation IIa, Level of Evidence C

- Discontinue warfarin 5 days before surgery and wait for INR <1.5 to perform the procedure.
- UFH or prophylactic LMWH can be used in the preoperative period if indicated.
- Postoperatively, use UFH or prophylactic LMWH if indicated by the type of procedure and resume warfarin 12 to 14 hours after surgery.

Patients at Low Risk of Thromboembolism

Degree of Recommendation I, Level of Evidence C

- Discontinue warfarin 5 days before surgery and wait for INR <1.5
- Start full-dose UFH or LMWH when INR <2.0
- Discontinue intravenous UFH 4 hours before surgery and subcutaneous LMWH 24 hours before surgery
- Postoperatively, restart full-dose UFH or LMWH and warfarin and 12 to 24 hours after the procedure and discontinue heparin only when the INR is within therapeutic range

Patients at Intermediate Risk of Thromboembolism

Degree of Recommendation IIa, Level of Evidence C

- Depending on the individual assessment of each patient, the guidelines can be followed either for the high or low risk to the discretion of the physician in charge.

Procedures with Low Risk of Bleeding

Degree of Recommendation I, Level of Evidence C

- Perform the procedure with an INR within the therapeutic range – it is not necessary to discontinue the anticoagulant.
- If INR >3, discontinue anticoagulation therapy one or two days before surgery and reintroduce it the night after surgery.

Urgent Procedures

- Discontinuation of anticoagulant, intravenous administration of vitamin K and replacement of deficient factors with prothrombin complex concentrate or fresh frozen plasma, according to the availability of these products.

Endocarditis Prophylaxis

Dental Procedures and Prevention of Infective Endocarditis

Dental procedures with higher risk for bacteremia are: subgingival placement of antibiotic fibers or strips, dental extractions, dental implants or reimplants, endodontic and periodontal procedures, placement of orthodontic bands, and procedures with significant bleeding. Whenever high-risk patients undergo these procedures should receive antibiotic prophylaxis; Degree of Recommendation I, Level of Evidence C. It is likely that low-income populations with little access to health care, with heart diseases other than those cited in Table 2 (below) also benefit from infective endocarditis (IE) prophylaxis before dental procedures; Degree of Recommendation IIa, Level of Evidence C.

Table 2. Patients at Risk of Acquiring Severe Infective Endocarditis

Patient with prosthetic heart valve
Valvular heart disease corrected with prosthetic material
History of infective endocarditis
Acquired valvular heart disease in patient who underwent heart transplant
Uncorrected cyanotic congenital heart disease
Corrected cyanotic congenital heart disease that evolves with residual lesion
Congenital heart disease corrected with prosthetic material

Surgical Procedures and Prevention of Infective Endocarditis

Indications for Endocarditis Prophylaxis

Degree of Recommendation I

- Prophylaxis for patients at high risk for severe IE (see Table 2, above) and who will be subjected to dental procedures with a high probability of significant bacteremia (see Table 3, below). Antibiotic regimen (see Table 10 in the original guideline document); Level of Evidence C.

Table 3. Dental Procedures and Indication of Infective Endocarditis Prophylaxis

Indicated	Not Recommended – Any Patients Who Will Undergo the Procedures Below
For patients at risk for severe infective endocarditis and who will undergo procedures involving manipulation of gingival tissue, periodontal region, or perforation of oral mucosa	Local anesthesia in non-infected tissue
	Dental X-ray
	Placement or removal of braces
	Adjustment of braces
	Placement of parts in braces
	Natural loss of milk tooth
	Bleeding originated from the trauma of the

Indicated	Not Recommended – Any Patients Who Will Undergo the Procedures Below
	oral mucosa or lips

Degree of Recommendation IIa

- Prophylaxis for patients with valvular heart disease or congenital heart disease that do not meet the criteria on Table 2 (above) and who will undergo dental procedures with a high probability of significant bacteremia (see Table 3, above). Antibiotic regimen (see Table 10 in the original guideline document); Level of Evidence C.
- Prophylaxis for patients at high risk for severe IE (see Table 2, above) and who will undergo genitourinary or gastrointestinal procedures associated with mucosal lesion. Antibiotic regimen (see Table 11 in the original guideline document); Level of Evidence C.
- Prophylaxis for patients at high risk for severe IE (see Table 2, above) and who will undergo esophageal or respiratory tract procedures associated with mucosal lesion. Antibiotic regimen (see Table 10 in the original guideline document); Level of Evidence C.

Degree of Recommendation IIb

- Prophylaxis for patients with valvular heart disease or congenital heart disease that do not meet the criteria in Table 2 (above) and who will undergo dental procedures that do not meet the criteria on Table 3 (above). Antibiotic regimen (see Table 10 in the original guideline document); Level of Evidence C.
- Prophylaxis for patients with valvular heart disease or congenital heart disease that do not meet the criteria in Table 2 (above) and who will undergo genitourinary or gastrointestinal procedures associated with mucosal lesion. Antibiotic regimen (see Table 11 in the original guideline document); Level of Evidence C.
- Prophylaxis for patients with valvular heart disease or congenital heart disease that do not meet the criteria in Table 2 (above) and who will undergo esophageal or respiratory tract procedures associated with mucosal lesion. Antibiotic regimen (see Table 10 in the original guideline document); Level of Evidence C.

Degree of Recommendation III

- There is no indication for IE prophylaxis in patients with interatrial communication alone; interventricular communication, or corrected patent ductus arteriosus and without residual flow; myocardial revascularization surgery; mitral valve prolapse without regurgitation after placement of stents; innocent heart murmurs; patients with pacemakers or implantable cardioverter-defibrillators (ICDs); history of Kawasaki disease or rheumatic fever without valve dysfunction who will undergo dental, esophageal, respiratory tract, genitourinary, or gastrointestinal procedures.
- There is no indication for procedures that do not involve risk of bacteremia.

Glycemic Control

Preoperative

Preoperative Glycemic Control in the Outpatient

Degree of Recommendation I

- Request fasting glucose and glycated hemoglobin for all diabetic patients; Level of Evidence C.
- Request fasting glucose for patients with no history of diabetes mellitus (DM); Level of Evidence C.
- Keep fasting glucose between 90 and 130 mg/dL, postprandial glycemia (2h) up to 180 mg/dL and glycated hemoglobin <7%; Level of Evidence A.
- The individualization of goals should be considered for elderly patients, patients with congestive heart failure (CHF), children, and pregnant women; Level of Evidence C.
- There is insufficient evidence to support the postponement of elective surgery based on the value of fasting glucose and glycated hemoglobin, however hemoglobin A1c (HbA1c) >9% represents mean glycemia of >212 mg/dL, being reasonable to adjust the control before surgery; Level of Evidence C.

Ideal Time to Discontinue Medications

Degree of Recommendation I, Level of Evidence C

- Biguanides (metfomin): 24 to 48 hours before
- Sulfonylureas
    - 1st generation (chlorpropamide) - 48 to 72 hours before

    - 2nd and 3rd generation (gliclazide, glibenclamide, glipizide, glimepiride) - on the day of surgery
- Thiazolidinediones (rosiglitazone, pioglitazone): on the day of surgery
- Acarbose: 24 hours before
- Glinides (repaglinide, nateglinide): on the day of surgery
- Neutral protamine Hagedorn (NPH) insulin, glargine, and detemir: evening dose can be maintained; in the morning of the surgery day, administer
    - 2/3 of the NPH insulin dose or slow-acting insulin when the surgery is performed early in the morning
    - 1/2 of the NPH insulin dose or slow-acting insulin when the surgery is performed in the morning
    - 1/3 of the NPH insulin dose or slow-acting insulin when the surgery is performed in the afternoon
- Fast-acting or ultra-fast acting insulin – discontinue fixed prandial doses and keep staggered scheme while fasting
- The adjustment of drug doses aimed at better glycemic control may require the aid of experts especially in insulin therapy users

Preoperative Glycemic Control in In-hospital Patient

Degree of Recommendation I

- Monitoring of capillary glycemia in diabetic patients; Level of Evidence A.
- To evaluate the HbA1c of these diabetic patients performed in an outpatient setting, if available
- Control goals for patients with hyperglycemia; Level of Evidence C
    - Pre-prandial glycemia from 100 to 140 mg/dL
    - Random glycemia up to 180 mg/dL
    - Avoid hypoglycemia: below 70 mg/dL
    - Avoid variability (peaks and valleys)
- The goals may be different in specific subgroups such as pregnant women, elderly, patients with severe comorbidities or heart failure
- Monitor fasting and random capillary glycemia in patients who are users of oral medications with HbA1c <9%. Level of Evidence C.
- In patients taking oral medications with HbA1c ≥9%, consider delaying surgery or briefly controlling with insulin, evaluation with a specialist for brief control with insulin, capillary glycemia before meals and at bedtime; Level of Evidence C.
- In patients using insulin, measure capillary glycemia before meals and at bedtime
- The adjustment or addition of oral medications are not indicated for rapid glycemic control in inpatients. Oral medications are slow acting and have limitations for some patients, such as patients with heart failure and/or renal failure. The best way to do it is through insulinization using several regimens (basal-prandial insulin with glucose correction); Level of Evidence C. If necessary request the assistance of a specialist.

Glycemic Control on the Day of Surgery (Fasting) for Patients with Hyperglycemia

Degree of Recommendation I

- Patients with diabetes should preferably be operated in the first hours of the day, especially those using insulin; Level of Evidence C.
- Hypoglycemia and glycemic variability should be avoided.
- Monitor capillary glycemia every 6 hours in patients who are users of oral hypoglycemic agents and every 4 hours in patients using insulin; Level of Evidence C.
- Keep glycemia between 100 and 180 mg/dL; Level of Evidence C.
- Suggestion staggered scheme while fasting
    - 141 to 180 mg/dL = 01 UI; 181 to 200 mg/dL = 02 UI; 201 to 250 mg/dL = 03 UI; 251 to 300 mg/dL = 04 UI; 301 to 350 mg/dL = 06 UI; 351 to 400 mg/dL = 08 UI; above 401 mg/dL = consider using intravenous insulin pump or postponing elective surgery until better control
- If glycemia levels below 100 mg/dL = install intake of glucose in 5 to 10 g/hour (e.g.; 100 mL/h of 5% serum glucose)
- If glycemia below 70 mg/dL = 60 ml bolus of intravenous 25% hypertonic glucose, install glucose intake in 5 to 10 g/hour (prefer 10 g/hour), repeat blood glucose test repeat every 15 minutes until above 80 mg/dL.

Patients with Diabetes Mellitus Type 1

- Pre-hospitalization evaluation and intra-hospital follow-up with a specialist are recommended, if available.
- Monitor capillary glycemia: pre-meal and at 10 p.m. while keeping usual diet, every 4 hours during fasting, and every hour or two hours while using continuous intravenous insulinization.
- Never replace basal-bolus insulin in the preoperative period with staggered scheme alone – risk of diabetic ketoacidosis.
- Surgery preferably early in the morning.

- In medium to major surgeries or those lasting for over one hour, ideally use continuous intravenous insulin pump as soon as starting fasting or in the morning of surgery, keeping the therapy during the surgery and in the early postoperative period while fasting.
- Based on the limitations for the use of continuous intravenous insulinization out of intensive care environment, alternatively, the following can be used:
    - Keep the insulin the night before surgery.
    - On the day of surgery in the morning, reduce basal insulin according to the scheme described under "Ideal Time to Discontinue," above.
    - Remove prandial insulins, keeping basal insulin, capillary glycemia every 3 or 4 hours, and adding staggered scheme (prefer ultra-fast insulin).
    - Install intake of glucose in the morning of surgery (before the usual time of breakfast in the morning) – keep intake from 5 to 10 g/hour. The choice of the amount of grams per hour depends on the glycemic control.

Emergency Surgery in Diabetic Patients

- Measure glycemia before surgery.
- Correct hypoglycemia and keep supply of glucose from 5 to 10 g/hour. Preferably control hyperglycemia with intravenous insulinization and keep glycemia levels between 80 and 140 mg/dL.
- Attention to potassium correction.

Intraoperative Period

Degree of Recommendation IIa

- Capillary glycemia should be measured at anesthesia induction if surgery is prolonged (surgery longer than 1 hour) or if high-risk patient; Level of Evidence C.
- Intravenous administration of insulin to all type 1 diabetics (regardless of surgical size) and type 2 diabetic patients undergoing surgery with planned duration exceeding 1 hour or when glycemia is too uncontrolled is recommended; Level of Evidence C.
- The goal should be a glycemic control between 100 and 180 mg/dL during surgery, when this control is necessary.

Postoperative Period

Degree of Recommendation I

- Until more studies are conducted and more evidence is available to better understand what is the most appropriate treatment goal for glycemic control in the postoperative period of patients undergoing noncardiac surgery, it is recommended that patients be individually assessed and that generally a value around 140 mg/dL is a reasonable goal for patients who have the profile and clinical scenario similar to those described in the NICE-SUGAR study; Level of Evidence A.
- The indication, however, to initiate therapy with intravenous insulin is valid only for patients admitted to intensive care units and whose glycemic levels are above 180 mg/dL; Level of Evidence A.

Degree of Recommendation IIa

- For patients undergoing elective surgery with no complications, and postoperative period in non-intensive care units, usually there is no need for glycemic control with intravenous insulin and the same hypoglycemic regimen used before the surgery should be used; Level of Evidence C.

Anesthetic and Intraoperative Considerations

Supply and Consumption of Tissue Oxygen

Degree of Recommendation I

- During the perioperative period, the supply of tissue oxygen should be optimized with the purpose of adjusting tissue perfusion to avoid the occurrence of organ dysfunction; Level of Evidence A.
- The strategy for super-supply of oxygen (supra-maximum oxygen delivery) should be avoided because it does not result in prevention of organ dysfunction; Level of Evidence A.
- Volume replacement in the perioperative period should be careful and based on continually evaluated goals, preferably by means of dynamic parameters, such as pulse pressure (PP) delta (PP delta should be below 13%), systolic volume variation, increase in cardiac index (pulmonary artery catheter or echocardiography), and improvement in parameters of tissue perfusion such as mixed venous oxygen

saturation (SVO_2), lactate, and base excess; Level of Evidence A.

Degree of Recommendation IIa

- The optimization of oxygen supply should be accomplished through proper assessment of the patient's volume status, challenging the cardiovascular system by means of volume tests with continuous reassessments; Level of Evidence B.
- The use of inotropes such as dobutamine and dopexamine perioperatively in high-risk patients is indicated in cases of imbalance of oxygen supply and supply-consumption ratio when blood volume is adjusted. This should be initiated at low doses and the patient should be monitored for adverse effects such as ischemia and tachycardia; Level of Evidence B.
- Red blood cell transfusion should be performed in high-risk patients when there is tissue hypoxia or imbalance between oxygen supply and consumption; Level of Evidence A.
- Replacement of fluid can be done using crystalloid or colloid, with no significant differences between them. Crystalloids are the recommended option, especially when the volume to be replaced does not exceed 50 mL/kg because of its lower cost and fewer harmful effects; Level of Evidence B.
- In situations of massive fluid replacement (volumes above 60 mL/kg, the authors of the guideline recommend the use of lower molecular weight starches (tetrastarch) and/or albumin in association with crystalloid, provided that there are no contraindications; Level of Evidence B.
- A liberal strategy for fluid replacement in the perioperative period should be avoided, since this is associated with worse mortality rate; Level of Evidence B.

Hemodynamic Monitoring Guided by Goals

Degree of Recommendation I

- High risk patients should have cardiac hemodynamics monitored in order to optimize parameters such as cardiac output and/or venous oxygen saturation; Level of Evidence A.
- Central venous oxygen saturation around 70% should be a target of the perioperative management of patients at high surgical risk; Level of Evidence B.

Degree of Recommendation IIa

- Patients at high surgical risk should have central venous oxygen saturation monitored using a central venous catheter; Level of Evidence B.

Perioperative Monitoring of Cardiac Output

Recommendations for the perioperative use of pulmonary artery catheter:

Degree of Recommendation IIa

- Surgery for repair of abdominal aortic aneurysm; Level of Evidence C
- Patients with decompensated heart disease or cardiac dysfunction undergoing a major or high-risk surgical procedure; Level of Evidence B
- Patients undergoing surgery who develop shock; Level of Evidence B
- Patients with pulmonary hypertension undergoing a major or high-risk surgical procedure; Level of Evidence C
- Patients undergoing surgery who develop severe sepsis or septic shock; Level of Evidence B

Recommendation of other methods to measure cardiac output:

Degree of Recommendation IIa

- Noninvasive measurement of cardiac output in the perioperative period can be performed using FloTrac Vigileo, LiDCOplus or PiCCO; Level of Evidence B.

Degree of Recommendation IIb

- Optimization of cardiac output in the perioperative period of high-risk patients can be made noninvasively using FloTrac Vigileo, LiDCOplus or pulse-induced contour cardiac output (PiCCO); Level of Evidence C.

Choosing the Anesthetic Technique

Degree of Recommendation I

- Regional anesthesia is contraindicated in patients with coagulopathy, thrombocytopenia, or hemodynamic instability; Level of Evidence A.

Degree of Recommendation IIa

- Anesthetic monitoring should be done carefully to allow continued assessment of anesthetic depth using the lowest possible doses of drugs; Level of Evidence A.

Choice of Anesthetic Agent

Degree of Recommendation I

- Fast-acting drugs of short duration and low residual effect should be preferably used in all anesthetic procedures; Level of Evidence B.

Degree of Recommendation IIa

- Propofol should be avoided in hemodynamically unstable patients or patients with cardiac dysfunction; Level of Evidence B.
- Ketamine and etomidate are drugs of choice for anesthesia of unstable patients or patients with ventricular dysfunction; Level of Evidence B.

Maintenance of Body Temperature

Degree of Recommendation I

- Normothermia should be preserved for perioperative prevention of cardiovascular events; Level of Evidence A.

Perioperative Use of Nitroglycerin

Degree of Recommendation I

- Intraoperative nitroglycerin should be used only for blood pressure control in coronary artery disease patients, with no intention to prevent perioperative ischemia; Level of Evidence C.

Perioperative Ventilatory Support

Controlled Pressure versus Controlled Volume

- The comparison of different liquid ventilation intraoperatively demonstrated no benefit of one technique over another. A ventilatory method is not recommended over the other in order to prevent pulmonary complications.

Tidal Volume

Degree of Recommendation IIa

- The authors of the guideline recommend the use of tidal volume 8-10 mL/kg in volume control or peak/plateau inspiratory pressure sufficient to maintain the same volume in controlled pressure; Level of Evidence C.

Positive End-expiratory Pressure (PEEP)

- Use of PEEP during general anesthesia is recommended because it is associated with improvement of oxygenation and prevention of atelectasis; Level of Evidence B.

Alveolar Recruitment Maneuver

Degree of Recommendation IIa

- The use of recruitment maneuvers is a recommended intraoperatively practice in order to avoid alveolar collapse; Level of Evidence B.

Fraction of Inspired Oxygen

Degree of Recommendation I

- During induction of anesthesia, the use the fraction of inspired oxygen of 1 is recommended to ensure adequate oxygen to perform the intubation. During maintenance of anesthesia, fraction of inspired oxygen sufficient to maintain oxygen saturation above 98% should be used; Level of Evidence C.

Weaning from Mechanical Ventilation (MV)

Degree of Recommendation IIa

- The removal of the MV can be performed using pressure support ventilation (PSV) or synchronized intermittent mandatory ventilation (SIMV); Level of Evidence C.

Postoperative Analgesia and Postoperative Exercises to Increase Lung Volume

Degree of Recommendation IIa

- Obtaining adequate postoperative analgesia is associated with postoperative pulmonary function; Level of Evidence B.
- Postoperative maneuvers to increase mean lung volumes are demonstrably linked to the reduction of postoperative complications; Level of Evidence C.

Perioperative Surveillance

Degree of Recommendation I

- Patients with an estimated perioperative cardiac risk of ischemic nature must remain in semi-intensive or intensive care units undergoing electrocardiogram (Level of Evidence B) and troponin (Level of Evidence A) daily until the 3rd postoperative day since most events occur in this period.
- If troponin measurement is not available, the authors of the guideline recommend the replacement with creatine kinase-MB/creatine phosphokinase (CK-MB/CPK) curve 8/8h; Level of Evidence B.

Degree of Recommendation IIb

- ST segment monitoring in the perioperative period of high-risk patients; Level of Evidence C.

Definitions:

Levels of Evidence

A. Evidence in several populations from multiple randomized clinical trials or meta-analyses
B. Evidence in a limited group of populations from single randomized clinical trial or non-randomized clinical studies
C. Evidence in very limited group of populations from consensus and experts' opinions, case reports and series

Degree/Class of Recommendation - Reflecting the Size of Treatment Effect

Degree of Recommendation I - Benefit >>> Risk; the treatment/procedure must be indicated/administered

Degree of Recommendation IIa - Benefit >> Risk; the choice for the treatment/procedure may help the patient

Degree of Recommendation IIb - Benefit > Risk; is not defined if the treatment/procedure can help the patient

Degree of Recommendation III - Risk > Benefit; the treatment/procedure must not be performed since it does not help and may be harmful for the patient

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Any condition requiring surgery

Guideline Category

Diagnosis

Evaluation

Management

Prevention

Risk Assessment

Screening

Treatment

Clinical Specialty

Anesthesiology

Cardiology

Colon and Rectal Surgery

Dentistry

Neurological Surgery

Ophthalmology

Orthopedic Surgery

Plastic Surgery

Surgery

Thoracic Surgery

Intended Users

Physicians

Guideline Objective(s)

- To refine and unify the terminology used by the entire multidisciplinary team, including the patients and their family
- To establish new routines, change indication for surgery according to the information obtained during the perioperative evaluation
- To inform the patient and the team on the possible risks related to the intervention
- To decrease perioperative complications

Target Population

Any patient who requires surgery

Interventions and Practices Considered

Perioperative Medication/Prophylaxis/Management

1. Perioperative medical therapy (beta-blockers, statins, alpha agonists, antiplatelet therapy)
2. Venous thromboembolism prophylaxis (heparin, warfarin, dalteparin, tinzaparin, enoxaparin, fondaparinux, compression stockings, intermittent pneumatic compression, ambulation, inferior vena cava filter)
3. Assessment of perioperative risk for complications
4. Endocarditis prophylaxis (antibiotics)
5. Glycemic control (hypoglycemic agents and insulin neutral protamine Hagedorn [NPH])
6. Choice of anesthetic agent
7. Nitroglycerin during surgery

Perioperative/Intraoperative Patient Management

1. Specialist referral
2. Oxygen delivery
3. Hemodynamic monitoring
4. Cardiac output monitoring/optimization
5. Choice of anesthetic technique (regional versus general)
6. Management of body temperature
7. Ventilatory support
8. Perioperative electrocardiography surveillance
9. Management of type and timing of surgery

Major Outcomes Considered

- Cardiovascular complications
- Adverse surgical outcomes (cardiovascular or noncardiovascular)
- Morbidity and mortality
- Side effects, safety, and effectiveness of medications
- Rate of hospitalization
- Sensitivity and specificity of perioperative monitoring techniques
- Cost-effectiveness

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

The databases searched were PubMed, Scielo, and Lilacs. The guideline was updated, based on the last version of the guideline, and new evidence from 2007 to 2010 was obtained. There were no specific search terms. Articles published in Portuguese and English were included.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Levels of Evidence

A. Evidence in several populations from multiple randomized clinical trials or meta-analyses
B. Evidence in a limited group of populations from single randomized clinical trial or non-randomized clinical studies
C. Evidence in very limited group of populations from consensus and experts' opinions, case reports and series

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

Not stated

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Not stated

Rating Scheme for the Strength of the Recommendations

Degree/Class of Recommendation - Reflecting the Size of Treatment Effect

Degree of Recommendation I - Benefit >>> Risk; the treatment/procedure must be indicated/administered

Degree of Recommendation IIa - Benefit >> Risk; the choice for the treatment/procedure may help the patient

Degree of Recommendation IIb - Benefit > Risk; is not defined if the treatment/procedure can help the patient

Degree of Recommendation III - Risk > Benefit; the treatment/procedure must not be performed since it does not help and may be harmful for the patient

Cost Analysis

Venous Thromboembolism Prophylaxis

There is strong evidence in the literature that the appropriate thromboprophylaxis in surgical patients is cost-effective with a great cost-benefit relation.

Method of Guideline Validation

Peer Review

Description of Method of Guideline Validation

Not stated

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for most of the recommendations (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate management of steps to reduce surgical risk, which may result in reduced perioperative complications, morbidity, and mortality

Potential Harms

- Adverse effects caused by therapy, such as elevation of filling pressures and decreased cardiac index
- Antiplatelet agents
  - There is concern about increased bleeding complications in surgeries performed in patients who take antiplatelet agents. Current evidence suggests that in fact there is an increase of up to 50% in the rate of perioperative bleeding in patients taking antiplatelet agents, but no increase in the rate of severe bleeding, except in neurosurgery and transurethral resection of the prostate (example of procedure without primary hemostasis).
  - There is evidence suggesting higher rates of perioperative bleeding attributed to thienopyridines based mainly on studies in which these agents were used in combination with antiplatelet agents.
  - Specifically in relation to spinal anesthesia (spinal or epidural), there is concern regarding increased bleeding complications in patients who use antiplatelet agents. Spinal hematoma is a complication of this anesthetic technique; although rare, it can have catastrophic consequences if not promptly diagnosed and treated.
  - There is a risk of hemorrhagic complications associated with the use of potent antiplatelet agents such as clopidogrel.
- The use of inotropes such as dobutamine and dopexamine perioperatively in high-risk patients is indicated in cases of imbalance of oxygen supply and supply-consumption ratio when blood volume is adjusted. This should be initiated at low doses and the patient should be monitored for adverse
  effects such as ischemia and tachycardia.

Contraindications

Contraindications

- Contraindications to neuraxial blockade, such as coagulopathy, thrombocytopenia, and hemodynamic instability, should always be considered.
- Regional anesthesia is contraindicated in patients with coagulopathy, thrombocytopenia, or hemodynamic instability.
- It is important to emphasize that propofol is contraindicated in patients with hemodynamic instability or with reduced cardiovascular reserve because it is associated with intraoperative hypotension, shock, and metabolic acidosis.
- The use of low inspired oxygen concentrations (below 0.4) is not recommended during induction of anesthesia because it reduces the margin of safety if there is difficulty in handling the air.
- In elderly and diabetic individuals, or those at high risk of bleeding, avoid the use of antithrombotic drugs with renal metabolism.
- Do not use inferior vena cava filter as a thromboprophylaxis method in patients suffering from trauma.

Qualifying Statements

Qualifying Statements

- Data or scientific evidence are not always available to allow all the different situations to be analyzed. As customary in medical practice, minute analysis of the patient and problem and the common sense of the team must prevail.
- The surgical intervention does not finish when the patient is bandaged or leaves the operating room. The concept of the word perioperative includes the need for a postoperative surveillance whose intensity is determined by the individual level of risk of the patient.
- Although the indication of antibiotic prophylaxis for infective endocarditis before procedures involving the gastrointestinal or genitourinary systems has been eliminated from the recommendations of the American Heart Association, as explained in the original guideline document, there is indication of maintenance of prophylaxis for these procedures in Brazil. All guidelines should be interpreted with caution; but they should be useful as a second opinion and as a guide.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

Staying Healthy

IOM Domain

Effectiveness

Safety

Identifying Information and Availability

Bibliographic Source(s)

Gualandro DM, Yu PC, Calderaro D, Marques AC, Pinho C, Caramelli B, et al. Steps to reduce surgical risk. In: II guidelines for perioperative evaluation. Arq Bras Cardiol. 2011;96(3 Suppl 1):23-41. [379 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2007 (revised 2011)

Guideline Developer(s)

Brazilian Society of Cardiology - Medical Specialty Society

Source(s) of Funding

Brazilian Society of Cardiology

Guideline Committee

Not stated

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Financial Disclosures/Conflicts of Interest

See the original guideline document for mandatory conflict of interest declaration.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Arq Bras Cardiol 2007;89(6):e197-208.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the Arquivos Brasileiros de Cardiologia Web site

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Availability of Companion Documents

None available

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on June 3, 2008. The information was verified by the guideline developer on July 2, 2008. This summary was updated by ECRI Institute on December 26, 2008 following the FDA advisory on Innohep (tinzaparin). This summary was updated by ECRI Institute on July 27, 2010 following the FDA drug safety communication on Heparin. This NGC summary was updated by ECRI Institute on November 16, 2011. The updated information was verified by the guideline developer on December 27, 2011. This summary was updated by ECRI Institute on April 13, 2012 following the U.S. Food and Drug Administration advisories on Statin Drugs and Statins and HIV or Hepatitis C drugs. This summary was updated by ECRI Institute on March 10, 2014 following the U.S. Food and Drug Administration advisory on Low Molecular Weight Heparins. This summary was updated by ECRI Institute on August 12, 2014 to insert a notice that the DECREASE studies on the use of beta blockers in perioperative care have been discredited.

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